General

Guideline Title

ACR Appropriateness Criteria® chronic elbow pain.

Bibliographic Source(s)

Hayes CW, Roberts CC, Bencardino JT, Appel M, Arnold E, Baccei SJ, Chang EY, Fox MG, Fries IB, Greenspan BS, Hochman MG, Jacobson JA, Mintz DN, Mlady G, Murphey MD, Newman JS, Rosenberg ZS, Rubin DA, Small KM, Weissman BN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® chronic elbow pain. Reston (VA): American College of Radiology (ACR); 2015. 13 p. [69 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Hayes CW, Daffner RH, Weissman BN, Arnold E, Bancroft LW, Bennett DL, Blebea JS, Bruno MA, Fries IB, Kransdorf MJ, Luchs JS, Morrison WB, Palestro CJ, Roberts CC, Stoller DW, Taljanovic MS, Tuite MJ, Ward RJ, Wise JN, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic elbow pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 8 p. [52 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Chronic Elbow Pain

Variant 1: Evaluation for chronic elbow pain. First test.

Radiologic Procedure	Rating	Comments	RRL*
X-ray elbow	9		☢
MRI elbow without contrast	1		O
MRI elbow without and with contrast	1		O
MR arthrography elbow	1		O
CT elbow without contrast	1		☢☢

Radiologic Procedure	Rating	Comments	RRL*
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
CT arthrography elbow	1		☢☢
US elbow	1		O
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Mechanical symptoms (locking, clicking, limited motion); suspect intra-articular osteocartilaginous body or synovial abnormality; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Use of this procedure depends on availability and expertise. If effusion is present, procedure without contrast is preferred.	O
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Use of this procedure depends on availability, expertise, and local conditions.	O
CT elbow without contrast	8	This is an alternative procedure.	☢☢
CT arthrography elbow	8	This is an alternative procedure.	☢☢
US elbow	3		O
MRI elbow without and with contrast	1		O
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Suspect occult injury or other bone abnormality; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9		O
CT elbow without contrast	5		☢☢
Tc-99m MDP 3-phase bone scan elbow	4		☢☢☢
MR arthrography elbow	2		O
CT arthrography elbow	2		☢☢
MRI elbow without and with contrast	1		O
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
US elbow	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Assess stability of osteochondral injury; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	This is an alternative procedure.	O
MR arthrography elbow	9	This is an alternative procedure.	O
CT arthrography elbow	8	This is an alternative procedure.	☢☢
MRI elbow without and with contrast	5	This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.	O
CT elbow without contrast	3		☢☢
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
US elbow	1		O
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Palpable soft-tissue mass; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without and with contrast	9	Contrast may not be necessary in all cases.	O
MRI elbow without contrast	7	This is an alternative procedure for some masses.	O
US elbow	7	This is an alternative procedure.	O
CT elbow with contrast	3		☢☢
CT elbow without contrast	3		☢☢
CT elbow without and with contrast	2		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
CT arthrography elbow	1		☢☢
MR arthrography elbow	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Suspect chronic epicondylitis, refractory to empirical treatment; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	This is an alternative procedure.	O
US elbow	8	This is an alternative procedure.	O
MRI elbow without and with contrast	2		O
MR arthrography elbow	2		O
Tc-99m MDP 3-phase bone scan elbow	2		☢☢☢
CT elbow without contrast	1		☢☢
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
CT arthrography elbow	1		☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: Suspect collateral ligament tear; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Use of this procedure depends on availability, expertise, and local conditions.	O
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Use of this procedure depends on availability, expertise, and local conditions.	O
X-ray elbow stress views	6		☢
US elbow	6		O
CT arthrography elbow	5		☢☢
CT elbow without contrast	2		☢☢
MRI elbow without and with contrast	1		O
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Suspect biceps tendon tear; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	This is an alternative procedure.	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	1		O
MR arthrography elbow	1		O
CT elbow without contrast	1		☢☢
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
CT arthrography elbow	1		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Suspect nerve abnormality; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without contrast	9	This is an alternative procedure.	O
US elbow	8	This is an alternative procedure.	O
MRI elbow without and with contrast	2		O
MR arthrography elbow	1		O
CT elbow without contrast	1		☢☢
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
CT arthrography elbow	1		☢☢
Tc-99m MDP 3-phase bone scan elbow	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 10: Elbow stiffness; suspect heterotopic ossification/osteophytosis by radiograph. Next test.

Radiologic Procedure	Rating	Comments	RRL*
CT elbow without contrast	9		☢☢
MRI elbow without contrast	5		O
Tc-99m MDP 3-phase bone scan elbow	5	This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.	☢☢☢
CT elbow with contrast	1		☢☢
CT elbow without and with contrast	1		☢☢
MRI elbow without and with contrast	1		O
US elbow	1		O
MR arthrography elbow	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
CT arthrography elbow	1		☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 11: Suspect inflammatory arthritis or bursitis; radiographs obtained.

Radiologic Procedure	Rating	Comments	RRL*
MRI elbow without and with contrast	9	This is an alternative procedure.	O
MRI elbow without contrast	8	This is an alternative procedure.	O
US elbow	7	This is an alternative procedure.	O
Tc-99m MDP 3-phase bone scan elbow	3		☢☢☢
CT elbow without contrast	1		☢☢
CT elbow with contrast	1		☢☢
CT elbow with or without contrast	1		☢☢
MR arthrography elbow	1		O
CT arthrography elbow	1		☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Overview of Imaging Modalities

Chronic elbow pain may be caused by a variety of osseous abnormalities, soft-tissue abnormalities, or both. Radiography is most helpful for assessing bony structures, calcification, or ossification. Computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US) are the most commonly used additional imaging studies. Although CT and US can be used for specific indications, MRI effectively demonstrates most abnormalities in the elbow. MRI provides important diagnostic information for evaluating the elbow in many different conditions, including collateral ligament injury; epicondylitis; injury to the biceps and triceps tendons; and abnormality of the ulnar, radial, or median nerve; and for evaluating masses about the elbow joint. There are a lack of studies showing the sensitivity and specificity of MRI in many of these conditions; most studies demonstrate MRI findings in patients either known or highly likely to have a specific condition. Imaging choices will be considered for a variety of specific clinical variants in the following sections.

Discussion of Imaging Modalities by Variant

Variant 1: Evaluation for Chronic Elbow Pain. First Test

Radiographs are the best initial imaging study for a patient with chronic elbow pain. In some cases, radiographs may reveal the definitive cause of the problem (e.g., osseocartilaginous intra-articular body [IAB], osteophytes, heterotopic ossification, osteochondritis dissecans, or calcification in and around the joint in the form of hydroxyapatite deposition or calcium pyrophosphate crystal deposition). Exclusion of an osseous abnormality with radiographs may be helpful when conservative therapy is planned. Radiographs are also a useful adjunct to interpretation if musculoskeletal MRI is subsequently performed.

Instability may be difficult to diagnose clinically and some authors suggest that radiographic stress views can be helpful in diagnosing valgus instability. Specific techniques for obtaining these radiographs have been recommended and comparison to the unaffected side may also be of help.

Variant 2: Mechanical Symptoms (Locking, Clicking, Limited Motion); Suspect Intra-articular Osteocartilaginous Body or Synovial

Abnormality; Radiographs Nondiagnostic

CT and CT arthrography with single-contrast (iodinated contrast or air) and double-contrast (iodinated contrast and air) techniques are superior to radiography for detecting a chondral or osteochondral lesion or IAB. Both of these studies have limitations; a small IAB may be obscured by contrast or confused with air bubbles (double-contrast arthrography). A CT air arthrogram can avoid confusion of air bubbles with IABs. Regardless of method, detection of an IAB is limited by its size and location within the elbow joint, although detection is enhanced by the presence of joint effusion.

Some authors recommend MRI as the initial study. MRI following direct intra-articular contrast administration (MR arthrography) is preferred to routine MRI for diagnosing an IAB. MRI and MR arthrography are limited in their ability to detect purely cartilaginous lesions in the elbow.

Variant 3: Suspect Occult Fracture or Other Bone Abnormality; Radiographs Nondiagnostic

Initial evaluation should begin with radiography, but if the radiographs are nondiagnostic, both traumatic and stress fractures may be identified with MRI and 3-phase bone scan. CT may have utility in detection and further evaluation of acute traumatic elbow fractures, as well as limited usefulness in identifying stress fractures at the elbow. US is helpful in demonstrating lipohemarthrosis in cases of occult elbow fractures in children.

Variant 4: Assess Stability of Osteochondral Injury; Radiographs Nondiagnostic

Some authors advocate MRI as the initial study for suspected osteochondral fracture. Intravenous (IV) or intra-articular contrast has some limited usefulness in the diagnosis of chondral injuries on MRI. Both CT and MRI can assess for osteochondral fragment stability. MRI following direct intra-articular contrast administration (MR arthrography) can play a role in improving evaluation of stability of an osteochondral lesion. Similarly, CT arthrography provides more diagnostic information than standard CT in this setting. Although US may show osteochondral abnormalities in some situations, MRI offers a more comprehensive evaluation. IV contrast (indirect arthrography) used in conjunction with MRI can be useful in situations where direct arthrography is not an option.

Variant 5: Palpable Soft-Tissue Mass; Radiographs Nondiagnostic

Both MRI and US effectively evaluate suspected soft tissue masses around the elbow. IV contrast is needed for MR evaluation of some, but not all, soft-tissue masses. For example, simple lipoma has a characteristic appearance without contrast. CT can be used as an alternative procedure, particularly for patients who have a contraindication to MRI, but is a second-tier imaging study. As with MRI, IV contrast can be a useful adjunct for diagnosis but is not necessary in all cases. Since palpable soft tissue masses are typically located outside the joint, arthrography is not appropriate for initial evaluation of a mass. Masses with hyperemia or inflammatory masses may be detected with 3-phase bone scan. For more detailed information and references, see the National Guideline Clearinghouse (NGC) summary of American College of Radiology (ACR) Appropriateness Criteria® soft-tissue masses.

Variant 6: Suspect Chronic Epicondylitis, Refractory to Empirical Treatment; Radiographs Nondiagnostic

Epicondylitis, caused by tendon degeneration and tear of the common extensor tendon laterally ("tennis elbow") or the common flexor tendon medially (in pitchers, golfers, and tennis players), is a common clinical diagnosis. Imaging is usually not necessary. MRI or US may be useful for confirming the diagnosis in refractory cases and to exclude associated tendon and ligament tears. IV contrast does not significantly aid in diagnosis of this entity. Epicondylitis may be detected on 3-phase bone scan.

Variant 7: Suspect Collateral Ligament Tear; Radiographs Nondiagnostic

Radiographs can be useful to identify heterotopic calcification (ossification) of the ulnar collateral ligament. This finding may be associated with partial or complete tears of that structure. Avulsion of the ulnar collateral ligament at the insertion site on the ulna is a source of chronic medial elbow pain in the throwing athlete. Although US has been shown to detect medial epicondylar fragmentation of the humerus in throwing athletes, this finding is optimally evaluated with a combination of radiographs and MRI. MR arthrography has been advocated to distinguish complete tears from partial tears of the ulnar collateral ligament. At 3T, MR arthrography is more accurate than conventional MRI in detection of ligament tears. With the use of appropriate pulse sequences, MRI is an effective tool in the preoperative diagnosis of posterolateral rotatory instability. This includes assessment of the ulnar band of the lateral collateral ligament. Stress views may be useful in assessing medial or lateral stability.

Variant 8: Suspect Biceps Tendon Tear; Radiographs Nondiagnostic

US has been shown to be helpful for diagnosing abnormalities of the distal biceps and triceps tendons, flexor and extensor tendons, ligaments, and nerves, providing an alternative to MRI although MRI is typically used in this clinical scenario. Neither IV nor intra-articular contrast assists in MR diagnosis. Evaluation of the biceps tendon with CT is limited and not usually appropriate.

Variant 9: Suspect Nerve Abnormality; Radiographs Nondiagnostic

The ulnar nerve is particularly vulnerable to trauma from a direct blow in the region of the superficially located restricted space of the cubital tunnel. Anatomic variations of the cubital tunnel retinaculum can contribute to ulnar neuropathy. Axial T1-weighted MR images have been shown to depict the size and shape of the nerve, and axial T2-weighted or short tau inversion recovery images may show an increased signal in the presence of neuritis. Both are more sensitive than conventional nerve conduction studies. US may also show ulnar nerve enlargement and increased vascularity and, when added to electrodiagnostic tests, increases sensitivity for the diagnosis of ulnar neuropathy at the elbow from 78% to 98%. A snapping of the medial head of the triceps can cause recurrent dislocation of the ulnar nerve. This diagnosis can be confirmed with MRI or CT using axial images with the elbow in flexion and extension. US is ideal for dynamic assessment of ulnar nerve subluxation and dislocation, as well as for confirmation of snapping triceps syndrome. Radial nerve, median nerve, and other entrapment syndromes can also be evaluated with MRI.

Variant 10: Elbow Stiffness; Suspect Heterotopic Ossification/Osteophytosis by Radiography. Next Test

CT is superior to radiography in the preoperative assessment of osteophytosis or heterotopic ossification in the patient with symptomatic stiff elbow. The inflammatory component of heterotopic ossification can be detected on the early phases of a 3-phase bone scan, and the delayed images will reveal increased uptake due to the bone formation. Bone scintigraphy has been used in early detection of heterotopic ossification and in assessing its metabolic activity to appropriately time surgical removal. MRI can also be used for this diagnosis, but osseous detail is inferior to CT. IV contrast does not contribute to this diagnosis. The use of US is limited because of shadowing from bone formation.

Variant 11: Suspect Inflammatory Arthritis or Bursitis; Radiographs Obtained

Chronic elbow pain can also be caused by a number of joint-related processes, such as inflammatory arthritis and synovial proliferative disorders. Evaluation begins with radiography to assess for joint distention and erosions. MRI can also show erosions and is effective in characterizing synovitis (a low signal suggests hemosiderin) and the extent and activity of disease. In the setting of rheumatoid arthritis, US can also be used to detect joint effusion, synovitis, and erosions. Bicipitoradial and interosseous bursitis around the distal biceps tendon is a source of elbow pain that can be assessed with MRI or US. MRI also demonstrates the effects of the bursa on adjacent structures, including the posterior interosseous and median nerves. Inflammatory arthritis or bursitis can be detected by the early phases of a 3-phase bone scan, as well as on the delayed images, by increased uptake.

For imaging of osseous tumors see the NGC summaries of ACR Appropriateness Criteria® primary bone tumors and ACR Appropriateness Criteria® metastatic bone disease.

Summary of Recommendations

- Initial evaluation of chronic elbow pain should begin with radiography.
- Chondral and osteochondral abnormalities can be further evaluated with MRI or CT. The addition of arthrography is helpful, especially for detecting intra-articular bodies.
- Radiographically occult bone abnormalities can be detected with MRI, CT, or bone scintigraphy.
- Soft-tissue abnormalities (tendon, ligament, nerve, joint recess, and masses) are well-demonstrated with MRI or US.
- Dynamic assessment with US is effective for diagnosing nerve or muscle subluxation.

Abbreviations

- CT, computed tomography
- MDP, methylene diphosphonate
- MR, magnetic resonance
- MRI, magnetic resonance imaging
- Tc, technetium
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Chronic elbow pain

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Neurology

Nuclear Medicine

Radiology

Rheumatology

Sports Medicine

Intended Users

Advanced Practice Nurses

Health Plans

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of radiologic examinations for chronic elbow pain

Target Population

Patients with chronic elbow pain

Interventions and Practices Considered

1. X-ray
2. Magnetic resonance (MR) arthrography
3. Magnetic resonance imaging (MRI)
    - Without contrast
    - Without and with contrast
4. Computed tomography (CT)
    - With contrast
    - Without contrast
    - Without and with contrast
5. CT arthrography
6. Ultrasound (US)
7. Technetium (Tc)-99m 3-phase bone scan

Major Outcomes Considered

- Utility of imaging modalities in differential diagnosis
- Sensitivity and specificity of imaging modalities

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 52 citations in the original bibliography 37 were retained in the final document. Articles were removed from the original bibliography if they were more than 10 years old and did not contribute to the evidence or they were no longer cited in the revised narrative text.

A new literature search was conducted in July 2013 and updated in July 2014 to identify additional evidence published since the *ACR Appropriateness Criteria® Chronic Elbow Pain* topic was finalized. Using the search strategies described in the literature search companion (see the "Availability of Companion Documents" field), 61 articles were found. Nine articles were added to the bibliography. Fifty-two articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, the results were unclear, misinterpreted, or biased, or the articles were already cited in the original bibliography.

The author added 20 citations from bibliographies, Web sites, or books that were not found in the new literature search. Three citations are

supporting documents that were added by staff.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

Of the 52 citations in the original bibliography 37 were retained in the final document. The new literature search conducted in July 2013 and updated in July 2014 identified nine articles that were added to the bibliography. The author added 20 citations from bibliographies, Web sites, or books that were not found in the new literature search. Three citations are supporting documents that were added by staff.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

> The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
>
> *Or*
>
> The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
>
> *Or*
>
> The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development documents (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND/UCLA Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. An initial survey is conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness (additional assumptions regarding rating appropriateness can be found in the document Rating Round Information). When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate," is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement after the first rating round, a conference call is scheduled to discuss the evidence and, if needed, clarify the variant or procedure description. If there is still disagreement after the second rating round, the recommendation is "may be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized, and economical process. For additional information on the ratings process see the Rating Round Information document.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria (AC).

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

Summary of Evidence

Of the 69 references cited in the American College of Radiology (ACR) Appropriateness Criteria® Chronic Elbow Pain document, all of them are categorized as diagnostic references, including 1 well designed study, 8 good quality studies, and 14 quality studies that may have design limitations. There are 46 references that may not be useful as primary evidence.

While there are references that report on studies with design limitations, 9 well designed or good quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with chronic elbow pain

Potential Harms

Relative Radiation Level

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

- The American College of Radiology (ACR) Committee on Appropriateness Criteria (AC) and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by

the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

- ACR seeks and encourages collaboration with other organizations on the development of the ACR AC through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Hayes CW, Roberts CC, Bencardino JT, Appel M, Arnold E, Baccei SJ, Chang EY, Fox MG, Fries IB, Greenspan BS, Hochman MG, Jacobson JA, Mintz DN, Mlady G, Murphey MD, Newman JS, Rosenberg ZS, Rubin DA, Small KM, Weissman BN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® chronic elbow pain. Reston (VA): American College of Radiology (ACR); 2015. 13 p. [69 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2015

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

Composition of Group That Authored the Guideline

Panel Members: Curtis W. Hayes, MD (*Principal Author*); Catherine C. Roberts, MD (*Panel Chair*); Jenny T. Bencardino, MD (*Panel Vice-chair*); Marc Appel, MD; Erin Arnold, MD; Steven J. Baccei, MD; Eric Y. Chang, MD; Michael G. Fox, MD; Ian Blair Fries, MD; Bennett S. Greenspan, MD, MS; Mary G. Hochman, MD; Jon A. Jacobson, MD; Douglas N. Mintz, MD; Gary Mlady, MD; Mark D. Murphey, MD; Joel S. Newman, MD; Zehava Sadka Rosenberg, MD; David A. Rubin, MD; Kirstin M. Small, MD; Barbara N. Weissman, MD (*Specialty Chair*)

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Hayes CW, Daffner RH, Weissman BN, Arnold E, Bancroft LW, Bennett DL, Blebea JS, Bruno MA, Fries IB, Kransdorf MJ, Luchs JS, Morrison WB, Palestro CJ, Roberts CC, Stoller DW, Taljanovic MS, Tuite MJ, Ward RJ, Wise JN, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic elbow pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 8 p. [52 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the American College of Radiology (ACR) Web site .

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Oct. 3 p. Available from the American College of Radiology (ACR) Web site .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of Radiology; 2015 Apr. 5 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2015 Sep. 3 p. Available from the ACR Web site .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 2015 129 p. Available from

the ACR Web site .

- ACR Appropriateness Criteria® chronic elbow pain. Evidence table. Reston (VA): American College of Radiology; 2015. 18 p. Available from the ACR Web site .
- ACR Appropriateness Criteria® chronic elbow pain. Literature search. Reston (VA): American College of Radiology; 2015. 2 p. Available from the ACR Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI on July 31, 2002. The updated information was verified by the guideline developer on October 1, 2002. This summary was updated by ECRI on January 4, 2006. The updated information was verified by the guideline developer on January 19, 2006. This summary was updated by ECRI Institute on June 25, 2009. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on February 28, 2012. This summary was updated by ECRI Institute on January 20, 2016.

Copyright Statement

Disclaimer

NGC Disclaimer